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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/874,606	06/05/2001	Stephen L. Skala	PHA 51243A	6706

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EXAMINER

IM, JUNGHWA M

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 12/04/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/874,606

Applicant(s)

SKALA ET AL.

Examiner

Junghwa M. Im

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Claim Objections

Claims 5 and 20 are objected to because of the following informalities.

Claim 20 is a duplicate of claim 5 and both claims depend on claim 1.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 15, passivation material can not be arranged partially over the passivation material as recited.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-4, 15 and 16 are rejected under 35 U.S.C. 103 as being unpatentable over Bourg, Jr et al. (U.S. Pat. No. 5,424, 581) in view of Greer (U.S. Pat. No. 6,451,681).

Regarding claim 1, Bourg, Jr et al. teach, in Fig. 3, a semiconductor chip having circuitry, the semiconductor chip comprising:

a metal bond pad layer (15) over the circuitry and insulated on at least two sides by passivation material (22); and

a metal layer over (25) the circuitry, the metal bond pad the metal layer being configured and arranged for connecting to a wire bond.

Bourg, Jr et al. do not show that a diffusion barrier layer over the metal bond pad while at least two entire sides of the diffusion layer being insulated by the passivation material and the limitation over the contact configuration between the layers.

However, Greer shows in Fig.3, the diffusion barrier layer (200, 202), and at least partially over the passivation material (300, 302) and a metal layer (314) over the circuitry, the metal bond pad (128), the diffusion barrier layer (300,302), and at least partially over, and in contact with, a portion of the passivation material not over the diffusion barrier layer, and wherein the diffusion barrier layer being constructed and arranged to mitigated inter-metallic aluminum-based compounds forming as a reaction to the metal layer connecting to the wire bond (col. 3, lines 61-67).

It would have been obvious to form a layer such as 200, 202 in Fig. 3 as taught

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by Greer on the exposed portion of Bourg, Jr et al., metal 1 for reasons taught by Greer
at column 3, line 43- column 4, line 12.

Regarding claim 2, Greer teaches that the diffusion barrier layer includes TiN
(col. 3, line 55).

Regarding claims 3 and 4, Greer teaches a diffusion barrier layer (200 and 204)
has a thickness that at least 1 micron (col. 3, line 50 – col. 4, line 9).

Regarding claim 15, in so far understood, Bourg, Jr et al. teach, in Fig. 3, a
semiconductor chip having circuitry, the semiconductor chip comprising:

a metal bond pad layer (15) over the circuitry and insulated on at least two sides
by passivation material (22); and

a metal layer over (25) the circuitry, the metal bond pad the metal layer being
configured and arranged for connecting to a wire bond.

Bourg, Jr et al. do not show that a diffusion barrier layer over the metal bond pad
while at least two entire sides of the diffusion layer being insulated by the passivation
material and the limitation over the contact configuration between the layers.

However, Greer shows in Fig.3, a diffusion barrier layer (200, 202) over the
metal bond pad (128)

a metal layer 314 over the diffusion barrier layer (200, 202), and the metal layer
being configured and arranged for connecting a wire bond, and the metal bond pad,
diffusion barrier layer and the metal layer all being insulated (by passivation layer 300,
302) on at least two sides by passivation material,

wherein the diffusion barrier layer being constructed and arranged to

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mitigated inter-metallic compounds forming as a reaction to the metal layer connecting to the wire bond, and the passivation material is constructed and arranged to be at least partially over the metal bond pad, and the diffusion layer.

The motivation for combining two teachings for the diffusion barrier layer and the specific contact configuration about the passivation layer has been discussed previously.

Note that claims 1 and 15 recite the same structure with the same emphasis on how the passivation layer is configured to cover the layers.

Claim 16 has been discussed previously.

Claim Rejections - 35 USC § 103

Claims 5-8, 10, 11 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bourg, Jr et al and Greer as applied to claim 1 above, and further in view of Camilletti et al.

Regarding claim 5, Camilletti et al. teach that a semiconductor chip is configured and arranged as a flip chip (col. 3, line 42).

It would have been obvious to one of ordinary skill in the art at the time of the invention to configure the device of Bourg, Jr et al and Greer as a flip chip with the teaching of Camilletti et al. since such an arrangement enables direct connection to a circuit and the bond pad.

Regarding claim 6, Camilletti et al. teach that the metal bond pad includes aluminum (col. 3, line 38).

It would have been obvious to have an aluminum bond pad in the device of Bourg, Jr et al and Greer with the teaching of Camilletti et al. since an aluminum bond is commonly employed on the IC dies with desirable conductivity.

In addition, it would have been obvious to one of ordinary skill in the art at the time of the invention to use an Al for the bond pad, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use. *In re Leshin*, 125 USPQ 416.

Claim 7 has been discussed previously.

Regarding claim 8, Camilletti et al. teach that the diffusion barrier layer is constructed and arranged to mitigate inter-metallic Al/Au compounds forming as a reaction to the metal layer Al/Au connecting to the wire bond (col. 8, line 32-50).

Regarding claim 10, Camilletti et al. teach that the metal bond pad and metal layer include the same type of metal (col. 8, line 8-14).

It would have been obvious to have an aluminum bond pad in the device of Bourg, Jr et al and Greer with the teaching of Camilletti et al. since the homogeneous material between the two layers provide better adhesion thus, improving the performance of the device

Regarding claim 11, Bourg, Jr et al and Greer disclose the most aspect of the instant invention as discussed previously in claims 1 and 2, except for an aluminum bond pad.

However, Camilletti et al. teach in Fig. 4, a semiconductor chip having an aluminum bond pad (11A) layer over the circuitry (col. 3, line 66).

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It would have been obvious to have an aluminum bond pad in the device of Bourg, Jr et al and Greer with the teaching of Camilletti et al. since an aluminum bond is commonly employed on the IC dies with desirable conductivity.

Also note that Camilletti et al. teach a metal layer over the circuitry and the metal layer being configured and arranged for connecting to a wire bond and the diffusion barrier layer being constructed and arranged to mitigated inter-metallic aluminum-based compounds forming as a reaction to the metal layer connecting to the wire bond (col. 8, lines 4-6 and col.8, lines 47-49).

Regarding claim 14, Bourg, Jr et al and Greer disclose the most aspect of the instant invention as discussed previously in claims 1 and 2, except for an aluminum bond pad.

However, Camilletti et al. teach in Fig. 4a semiconductor chip having an aluminum bond pad (11A) layer over the circuitry.

Motivation for combining three teachings has been stated previously.

In addition, note that claim 11 and 14 are identical.

That is,

(1) passivation material in claim 11 are replaced with an insulating means in claim 14. where passivation material is insulating means.

(2) a diffusion barrier layer in claim 11 is replaced with a barrier means in claim 14. Note that both of the pending claim recite that TiN is included in the layer (the means).

Claim Rejections - 35 USC § 103

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bourg, Jr et al, Greer and Camilletti et al. as applied to claim 11 above, and further in view of Shangguan et al.

Regarding claim 9, combined three teaching of Bourg, Jr et al, Greer and Camilletti et al. disclose all the limitations as recited in claim 8, except the specific thickness of the diffusion barrier layer and the metal layer.

Shangguan et al. show, in Fig. 1, that a flip chip having an aluminum bonding pad (12) which have a diffusion barrier layer (14) with a thickness at least 0.5 micron (col. 3, line 39) and a metal layer (16) with the thickness of 3 microns at least (col. 3, line 53).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teaching of Shangguan et al. into the device taught by Camilletti et al. since such thickness of the diffusion barrier layer and the metal layer will improve the stability of the device and alleviate the interaction between the metal layers.

In addition Greer also discloses the thickness of the diffusion barrier as discussed previously.

And even though the three combined teachings does not disclose the specific thickness for the metal layer, however, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an intended value for the metal

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thickness recited in pending claim, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller*, 105 USPQ 233.

Claims 12, 13 and 17-20 are discussed previously.

Response to Amendment

Applicant's arguments with respect to claims 1-14 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (703) 305-3998. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JMI
December 2, 2002

Sam Crane
Primary Examiner